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THE ALIGNMENT OF MEDIEVAL CHURCHES IN NORTHERN-CENTRAL ITALY AND IN THE ALPS AND THE PATH OF LIGHT INSIDE THE CHURCH ON THE PATRON SAINT'S DAY

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ABSTRACT

GPS surveys of 181 medieval churches situated in northern-central Italy and in the Alps demonstrate major axis alignments to the horizon positions of the rising and setting Sun or Moon. The geographic scope includes the Veneto region and the old Via Francigena pilgrim route, the 1,200 km tract from the Swiss Alps to southern Tuscany, passing through the cantons of Vaud and Valais and regions including the Aosta Valley, Piedmont, Lombardy, Emilia Romagna and Tuscany. Construction dates range up to the Romanesque Age. In most cases, the church's major axis coincides with the sunrise or sunset position on the Patron Saint's day to whom the church was dedicated or on one of the four Virgin Mary's medieval feast days, i.e: the Annunciation (25 March); Purification (2 February); Assumption (18 January, 15 August) and Nativity (8 September). Church alignments (major axis and windows) are derived from GPS ground surveys and were cross-referenced with medieval liturgical and astronomical sources as well as scholarly literature.

KEYWORDS: medieval churches, orientation, objective and written evidence, GPS survey, Italy and Alps: Veneto region and Via Francigena, Patron Saint's day, sunrise or sunset.

1. INTRODUCTION

An initial study of medieval Benedictine architecture in the Veneto region of Italy revealed that in the Middle Ages the Benedictines built their monastic churches according to well-defined rules, namely, the buildings were aligned to an exact point on the horizon where principally the Sun or the Moon rose or set on a significant astronomical or liturgical date (Spinazzè 2007/2008, 2015a).

In order to determine if other religious orders followed this same custom, subsequently, all medieval churches in Venice and in the Venetian Lagoon were analysed. Surprisingly, it was noted that in even such a morphologically limited context, about half of seventy-eight sacred buildings were aligned with the sunrise or sunset of the Sun on the Patron Saint's day of these churches (Spinazzè 2011). Alignments on the church Patron Saint day and on the principal feast days of the Virgin Mary were separately distinguished and, thus, a clear picture of all analysed sacred buildings appeared.

In a subsequent PhD project, the research was extended to the Alps and northern-central Italy to determine the geographic scope of calendric alignment in Romanesque (AD 900-1200) churches. The medieval sacred buildings included all different typologies: monastic and parish churches, oratories, domos and cathedrals, located on a variety of landscapes (i.e., countryside, mountains, valleys, isolated places and cities).

Because the proposed astronomical targets are composed of different church types, pre-determined architectural features, and locations over a wide topographically varied geographic area, any emerging pattern of astronomical alignments cannot be rejected as coincidental. Moreover, confidence in the accuracy of the astronomical alignment data is high as they are based on 3D georeferenced surveys which included calculated local horizon profiles (Spinazzè 2016).

2. METHODOLOGY

Firstly, it was necessary to determine the original construction period and the architectural history of each building. Then, the local geography was considered to identify any Roman roads field system (*centuriation*). For each sacred building an accurate georeferenced survey was carried out to understand its orientation. Together with these georeferenced surveys and the horizon altitudes, the azimuths of the apses, façade and selected original windows were measured and compared to hypothetical astronomical alignments. This produced two calculated values for each alignment: one for the astronomical horizon and one for the local horizon. Next, the val-

ues were compared to determine the relationship between the church's axis and the rising or setting of observable celestial bodies on holy days identified in primary liturgical and astronomical medieval sources (see Spinazzè 2016, chap. 4 and 5). Our analysis supports the hypothesis that, in medieval Roman Catholic Italy, there was indeed a tradition of orientating sacred buildings to rise and set points of particular celestial bodies on significant liturgical or astronomical dates. Various doctrines of the Church Fathers reflect the relevance of such cosmological symbolism supporting the propagation of the Faith during the Middle Ages.

Moreover, liturgical writings regarding customs linked to rituals and celebrations during the Mass show how ritual shaped the architectural form and alignment of sacred buildings. For example, during Mass the priest stood with his back turned to the believers and looked towards the East (Vogel 1964. De Blaauw 1994). Furthermore, from the *Bible* (*Malachi* 3.20; *Luca* 1.78, *The Apocalypse of John* 12.1), the doctrines of the Church Fathers (Cyprian (2nd Century), *De Dominica Oratione*. Tertullian (2nd/3rd Century), *Apologeticus*, 16-17. Origen (2nd/3rd Century), *Homilies on the Genesis*. Ambrose (4th Century), *Hexameron*, 1; *Epistulae*, 31. Sophronius of Jerusalem (6th/7th Century), *Sermon*, 1.1. Isidore of Seville (6th/7th Century), *On the Nature of the Things*) and the medieval abbots (Anastasius of Sinai (8th Century), *Hexameron*, IV. Suger (11th/12th Century), *De administratione, De edificiorum institutione* II.11) we learn of the great significance given to the two principal luminaries, namely the Sun and Moon, symbolically compared with Jesus Christ and Mary, the Mother of Jesus (Spinazzè 2016, chap. 4.2).

A fundamental work *De Astronomia libri decem* by Guido Bonatti (1276) explains in two chapters what a builder had to consider in order to transfer positive influences to houses, castles and even churches at the time of their construction and recommending a strict observation of the two luminaries and the planets (Bonatus 1506, tome IV, chap. 4 and 5, 200-201. Dykes 2010. Spinazzè 2014). This is perhaps the first text that gives some precise indication as to how a sacred building had to be orientated. Early Christian sources do not clearly testify as a church must be orientated, except in some ecclesiastic directives with the request to build the sacred building along the Equinox line (*Apostolic Constitutions* (II.57), 4th Century. Clement of Alexandria, *Stromata* (VII), 2nd Century. *Testamentum domini Nostri Jesu Christi* (I, *De constitutione ecclesiae*, XIX), 4th/5th Century. Isidore of Seville, 6th/7th Century, *Etymologiae* (XV.7) and later ones such as Jean Belet, *Rationale divinarum officiorum* (II, *De loco*), 12th Century. Charles Borromeo, *Instructionum fabricae et suppellectiliis ecclesiasticae* (X),

16th Century). Neither the *Pontificale Romanum (Liber Pontificalis, 5th/6th Century)* which gradually developed (5th-13th Century) and which contains the rites performed by Bishops, where it describes how the Bishop, standing with his mitre, lays the first foundation stone, does not indicate how the alignment should be: "*In fide Jesu Christi collocamus lapidem istum primum in hoc fundamento...*" (*Pontificale Romanum, 1855, 11*).

The texts of the Church Reform and Reformation reveal why this tradition up to the 14th Century was slowly abandoned, after which a clear distinction can be seen in the north-south alignments of sacred buildings. Protestant theologians consistently wrote that the Lord is not to be enclosed in a limited area as He is omnipresent (Gavanto, *De oration, II, chap. V, 16th/17th Century*) and William Asplin (1728, 34-35) said: "...nothing can be more unjust and indecent than for Men to pretend to limit God to any Place". This thought can be clearly understood by looking at the diagram (Figure 1) which shows that nearly all alignments of medieval churches analysed fell in the horizon sector where the Sun and Moon rise and set. Moreover, other polemical controversies occurred during that time, saying that to align a church on the Patron Saint's day was an impertinence as this would mean a preference away from the Lord. This protest led to the building of sacred buildings with a north-south direction (Bloxam 1882, 1, 285-287. Dudley 1846, 525). A good example can be seen in the archaeological site of Saint-Maurice d'Agaune (Switzerland) which conserves several church foundations layered one atop of another, dating from the 4th to 11th Centuries, all with the same orientation showing a solid tradition, orientated with the sunset on the Patron Saint's day, Saint Maurice (22 September). However, the church erected at the beginning of the 17th Century is rotated about 90°, signalling a clear break with this custom (Spinazzè 2015b; 2016, chap. 4.10).

3. INTERPRETATION OF THE RESULTS

Two definite clusters of alignments were found containing the same orientation: sacred buildings with alignments on the rising or setting Sun on the Virgin Mary's four feast days celebrated during the Middle Ages such as the Annunciation (25 March), Purification (2 February), Assumption (old feast 18 January, date changed in the 6th Century to 15 August; see Nicephori Callisti Xanthopuli 1574, 1092) and Nativity (8 September) and sacred buildings aligned on the rising or setting Sun on the Patron Saint's day to whom the church was dedicated. Further, it is significant to note that most of the churches with an alignment on Mary's feast days, especially the Annunciation and Assumption (15 August) days, are aligned with the setting Sun, alluded to the Pas-

sion of the Christ (Psalm 104 (103). Isidore, *Etymologie, VI, cap. XVII, XIX*. Saint Augustine, *Enarrationes in psalmos, XXVI, 54*). Moreover, the sunrise on the Purification and Assumption (18 January) may be seen as the Resurrection of Christ (Cyprian, *De Dominica Oratione, 35*), invoking the central concepts of Christian faith, the Paschal mystery.

It is surprising to notice that only a few churches are aligned with the Equinox-line (0° declination on the astronomical horizon) even though the Church Fathers recommended it. On the other hand, numerous churches are orientated to the sunset on March 25th, perhaps for the reason that the Equinox is only an astronomical signal, whereas the 25 March has a deep religious meaning, namely the Annunciation and the Immaculate Conception. Furthermore, in numerous Italian cities during the Middle Ages the new year started on the *Incarnatio Domini* 25 March. A good example is the city of Lucca where six churches inside the town (Saint Mary Forisportam; Saint John and Reparata; Saint Martin, Saint Michael; Saint Christophe; Saint Alexander) are aligned more or less along the *decumani* but are orientated exactly with the sunset on the 25 March at the time of the foundation of the sacred building, thus underlining the beginning of the year on the day of the Incarnation of the Lord (Spinazzè 2016, chap. 3.2.1).

It was also astonishing to observe that only a few sacred buildings were orientated towards the solstice points, either on local or astronomical horizons, despite the symbolic significance of the Sun: the summer solstice is seen as the "highest light" (Kreuser 1851, I, 38-48), therefore, compared with the magnificence of Christ, while the winter solstice incorporates the "new" Sun as it begins to grow from this moment on. This was seen as the Nativity of Christ since ancient times. On the other hand, more lunar alignments have been found, namely the lunistics (+28.5° declination on the astronomical horizon) whose full moon symbolises Mary Full of Grace (Spinazzè 2016, chap. 3.8-11).

For detailed information of alignment of each sacred building, see the different publications of the author, with the diagrams reporting the accurate drawings, surveys and calculations of each analysed church.

4. ALIGNMENTS ON THE CHURCH'S PATRON SAINT'S DAY

At the beginning of the last century researchers from various areas, especially from northern Europe, hypothesized that a sacred building could assume an orientation on the sunrise (Otte 1868, 10) on the Patron Saint's day to whom the church was dedicated (Nissen 1906. Eckstein, Buell, Hoerning 1995, CVI, I, 13-32). In these cases, the builders traced the lines of

the church waiting and observing the sunrise or the sunset of the Sun on the Patron's day of the church and then placing the first foundation-stone. Perhaps there were only poets and theologians who spoke about the orientation of sacred buildings over the centuries, bringing to light this old tradition and keeping this custom alive. One of them was the Romantic poet William Wordsworth (1770-1850) who wrote a poem in 1823 dedicating it to Lady Le Fleming who, in July of that year, laid the first stone of the Rydal Chapel (The Chapel of St. Mary, Rydal). Wordsworth chose the place where this church was to be erected, albeit in a hilly landscape. In his poem *On seeing the foundation preparing for the erection of Rydal Chapel, Westmoreland*, Wordsworth tells about the custom of his forefathers and, in particular, of the little known tradition regarding the orientation of English churches built in the past. He thought that the orientation of the churches should be determined by the sunrise on the Patron Saint's day. He does not say how and from whom he learned this custom. Poetically he describes the rite when the men wait impatiently for the sunrise of the Sun since the previous evening, in order to draw the line for the foundation. He gives fundamental evidence in his poem and affirms that the people continued to align the sacred buildings in that way as men had taught in the past, towards the point on the horizon where the Sun rose on the Patron Saint's day (Wordsworth 1902, 641-643). Similar evidence can also be found in the later work of the Abbot Richard Hart in 1846, *Ecclesiastical Records of England, Ireland, and Scotland, from the fifth century till the Reformation*: "...before the foundations were dug, the parishioners used to watch all night in the churchyard, on the vigil of their Patron Saint, and took that point in the horizon on which the Sun rose on the following day (his festival) for the east" (Hart 1846, 216).

William Wordsworth's poem:

On seeing the foundation preparing for the erection of Rydal Chapel, Westmoreland, 1823

"Our churches, invariably perhaps, stand east and west, but why is by few persons exactly known; nor, that the degree of deviation from due east often noticeable in the ancient ones was determined, in each particular case, by the point in the horizon, at which the sun rose upon the day of the saint to whom the church was dedicated. These observances of our ancestors, and the causes of them, are the subject of the following stanzas.

*When in the antique age of bow and spear
And feudal rapine clothed with iron mail,
Came ministers of peace, intent to rear
The Mother Church in yon sequestered vale;
Then, to her Patron Saint a previous rite*

*Resounded with deep swell and solemn close,
Through unremitting vigils of the night,
Till from his couch the wished-for Sun uprose.
He rose, and straight – as by divine command,
They, who had waited for that sign to trace
Their works' foundation, gave with careful hand
To the high altar its determined place;
Mindful of Him who in the Orient born
There lived, and on the cross his life resigned,
And who, from out the regions of the morn,
Issuing in pomp, shall come to judge mankind.
So taught their creed; – nor failed the eastern sky,
The sweet and natural hopes that shall not die,
Long as the sun his gladsome course renews.
For us hath such prelusive vigil ceased;
Yet still we plant, like men of elder days,
Our Christian altar faithful to the east,
Whence the tall window drinks the morning rays;
That obvious emblem giving to the eye
Of meek devotion, which erewhile it gave,
That symbol of the dayspring from on high,
Triumphant o'er the darkness of the grave".*

In the middle of the 20th Century some scholars, such as C.J.P. Cave and Hugh Benson, asked themselves, if Wordsworth's statement was true or not and there were thus considerable debates about the possible alignment of English churches with the sunrise on the Patron Saint's day. Cave measured 642 churches with a compass. In a group of sacred buildings dedicated to Saint Peter he noticed that the azimuths were too far from the position of the rising Sun on the St. Peter's feast, 29 June, thus rendering Wordsworth's thesis unreliable (Cave 1950, XXX, 47-51). However, Cave left out other important feast days of the Saint, namely his translation (16 April); the celebration of St. Peter's Chair in Rome (18 January); and his Chair in Antioch (Antakya) (22 February). It must also be remembered that the compass is a misleading tool as it marks the magnetic North Pole and not the True North and is affected by the presence of ferrous-magnetic material or electromagnetic fields. Cave did not correct the measurement of the azimuth for the values of the reflection, the local horizon altitude and the latitude, all factors which impact on the final calculation of the declination of the celestial body. He did not consider the error of the Julian Calendar or even the possible inclination of the church walls and of its apse. Furthermore, it is important to know the history of the church in depth, especially of its initial construction phase and to whom and why it was dedicated at its founding.

Some years later, the work of Cave was reviewed by Hugh Benson who considered some of the above mentioned aspects and stated that several sacred

buildings examined by Cave were orientated at the Assumption of Mary or to other important dates (Benson 1956, XXXVI, 205-217), each one in line with the church's own particular history.

Examining more closely the Rydal Chapel in Cumbria, the church in the direction of its façade-apse has an azimuth of $66^{\circ}15'$ with a $12^{\circ}08'$ altitude of the local horizon, corresponding to a declination of the rising celestial object of $23^{\circ}05'1$. Hence, the rising Sun in the year 1823 was in line with the church's axis on the July 2nd, the feast of the Visitation of the Blessed Virgin Mary, an important feast in England since the 14th Century, instituted by Pope Urban VI in 1378 and confirmed by Pope Gregory XI in 1380 and never dropped until 1969 when it moved to 31 May (Farmer 1980, *Mary the blessed Virgin*. Cappelli 1998, 149). The *Local Chronology* of the year 1865, reporting where all the local main events, affirms that the foundation stone of Rydal Chapel, erected and endowed by Lady Le Fleming of Rydal Hall, was laid on Wednesday, July 2nd, 1823. The new Chapel was then opened on Christmas Day for public worship and consecrated the following year (*Local Chronology*, 1865, 55, 60, 63. *Topographical Dictionary of England*, 1840, III, 639). This is a fundamental evidence proving the existence of the custom to align sacred buildings on the Patron Saint's day, in this case Mary.

Wordsworth not only fixes this old tradition in his poem for all time - which seemed to have been forgotten - but he ensured its revival with the new construction of the Rydal Chapel.

Our results show that nearly half of the medieval churches in Venice were aligned to the Saint's feast of the church as well as a fifth of the sacred buildings erected during 10th-12th Century along the Via Francigena (Swiss-Italian tract). In this last study, all the buildings aligned on the church Patron's day were dedicated to one of the first martyrs of Christianity and nearly half of them were in honour of Saint Peter (the collegiate church of Saint Peter and Ursus of Aosta; church of Saint Peter and Paul of Pessano; church of Saint Peter of Robbio; church of Saint Peter of Breme; abbey church of Saint Peter of Camaiore. Spinazzè 2016, chap. 3.7). The first Christian martyrs are remembered in the oldest surviving martyrology, the *Martyrologium Hieronymianum*, dating from about the 5th Century and widely used in the Middle

Ages. Of course, the local martyrology of the different places with their own saints must also be considered. Regarding Saint Peter, the following feasts are remembered in this old *Martyrologium*: the February 22nd, *Cathedrae sancti Petri Apostoli quam sedit apud antiochiam*, January 18th, together with the old Assumption feast of Mary *depositio sanctae Maiiae et cathedra Petri in Roma* and June 29th, the two apostles Peter and Paul *Natal sanctorum apostolorum petri et pauli* (*Martyrologium Hieronymianum*, 1894).

5. LIGHT INCIDENCE

Analysis of the light passing through the original openings single and double panel windows, as well as rose windows, by day and hour throughout the year led to a significant finding. In most cases, the altar, in its original position, was illuminated with the morning Sun on the days around the feast of the Patron Saint to whom the church was dedicated, i.e., the day of translation, when the mortal remains were moved to the church and enshrined. We find examples in the churches dedicated to Saint Peter in Pavia, in Camaiore and in Bollengo where on his saint's day (April 16th), the altar was illuminated by the rising Sun commemorating and celebrating his translation. This also occurred in the churches of Saint Martin, Arnad, on his translation day (July 4th) and Saint Stephan, Filattiera Sorano, on his translation day (May 7th) (Spinazzè 2016, chap. 3 and conclusion).

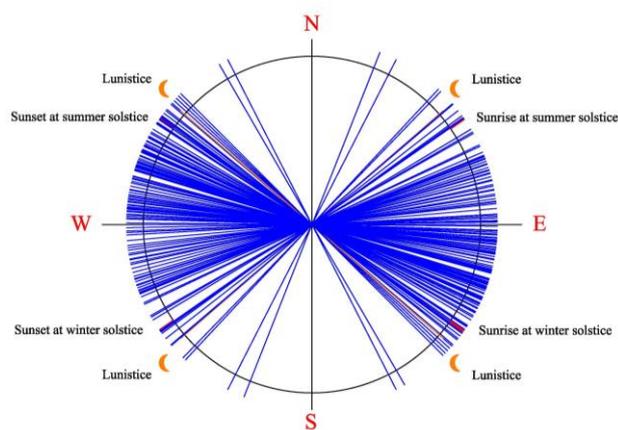


Figure 1. Diagram showing the 181 true azimuths of the medieval sacred buildings' axis analysed. E. Spinazzè.

¹ Geographic coordinates: latitude $54^{\circ}26'51''N$ and longitude $2^{\circ}58'54''W$. True azimuth in the direction façade-apse $66^{\circ}15'$ (error $\pm 30'$), in the direction apse-façade $246^{\circ}15'$ (error $\pm 30'$). The altitude of the local horizon in the apse direction $+12^{\circ}08'$ and in the façade direction $+6^{\circ}35'$. Declination of the rising celestial body on the local horizon of $+23^{\circ}05'37''$ and on the setting $-8^{\circ}29'29''$. Corresponding days on the sunrise on the mountainous profile for the year 1823: 2-3 July and 12 June; on the sunset: 28 February and 16 October.

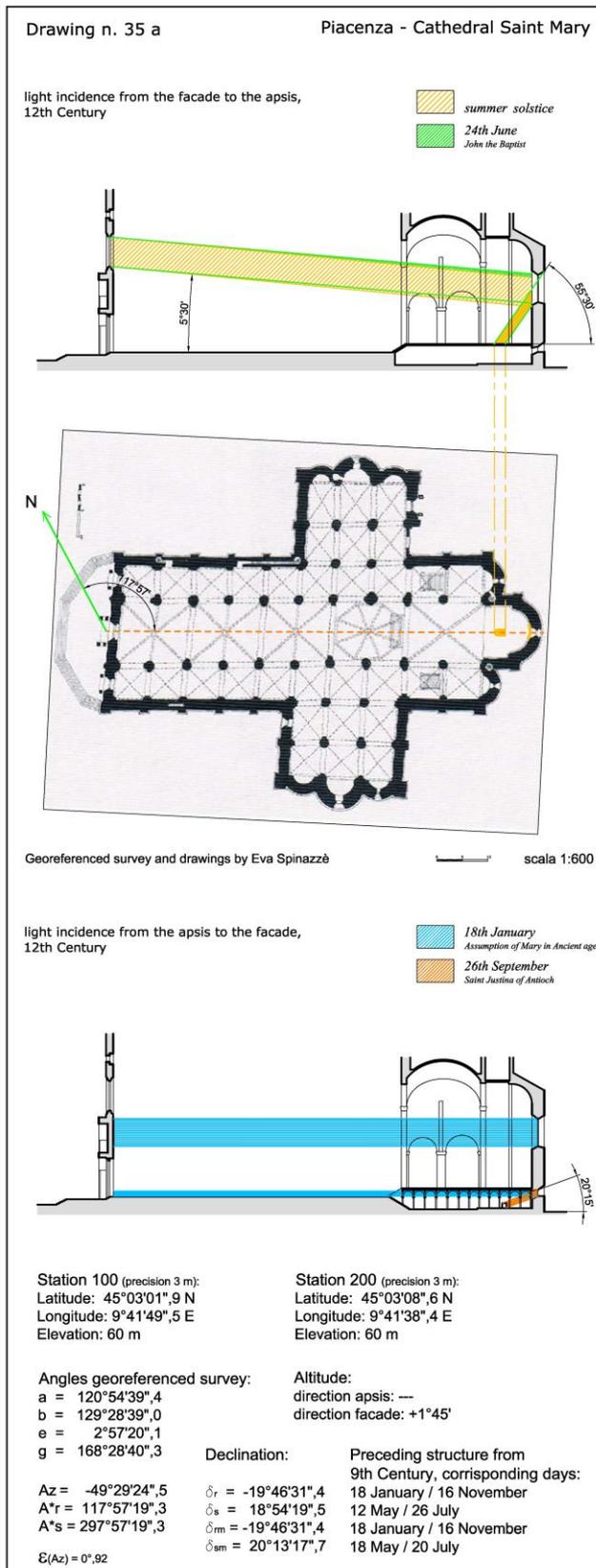


Figure 2. The study of the light and orientation of the Cathedral Saint Mary in Piacenza (Italy), 12th Century. E. Spinazzè.



Figure 3. Cathedral of Saint Mary, Piacenza (Italy), summer solstice 2013. E. Spinazzè.

The Cathedral of Piacenza, rebuilt in the 12th Century after the earthquake of 1117 and dedicated to Mary's Assumption, is orientated on the local horizon with the sunrise on her Early Christian Assumption feast day (18 January). Around this day, the light coming from the apse window illuminated the the counter-façade. At the same time, the light coming from crypt window was crossing the whole nave, along its axis. It could be noted that Early Christian churches dedicated to Mary were often aligned with January 18th and only in later centuries August 15th was preferred (Spinazzè 2016). This fact supports the hypothesis of the historian Giorgio Monaco, that the Cathedral of Piacenza most probably overlays on the foundation of an Early Christian church (Monaco 1975, 5-6) and both share the same orientation.

Around the summer solstice, the "highest light" of the setting sun passes through the large rose on the façade, traverses the entire nave, and exits out the apse window, symbolizing even today this fundamental moment, the magnificence of the *Christus Verus Sol* (Wallraff 2001). In the morning, this "highest light" brightened the altar. Furthermore, after analysing the altar in the crypt where the relics of Saint Justina of Antioch, the patron of the city, have been preserved since the end of the 11th Century, the altar was found to be in full light on her commemoration day (26 September), underlining her solemn translation and collocation to Piacenza (Figures 2 and 3. Spinazzè 2016, chap. 3.4).

6. CONCLUSION

The archaeoastronomical results from 181 sacred medieval buildings up to the Romanesque age demonstrate that 169 of 181 (93.3%) major axis point to the rising or setting of the Sun or Moon in a significant astronomical or liturgical day, indicating for each a deliberate and proper alignment. Two definite orientation patterns arose from the research: alignments with the rising or setting Sun on the four Mary feast days commemorated during the Medieval period: Annunciation, Purification, Assumption and Nativity of the Virgin Mary (73 of 181 = 40.3%); and alignments with the rising or setting Sun on the relevant Patron Saint's day (56 of 181 = 30.9%) and especially on his day of translation. Interestingly, the alignments on the Annunciation (25 March), Nativity (8 September) and Assumption (15 August) are mainly aligned with the setting Sun (42 of 58 = 72.4%), while the alignments on the Purification (2 February) and Assumption (18 January) are aligned with the rising Sun (12 of 13 = 92.3%). Even though ecclesiastic directives recommended that church axes be on the equinox line, only a few sacred medieval buildings are aligned with the equinox sunrise (6 of 181 = 3.3%). However, there are many medieval churches aligned with the Sun of the March 25th (34 of 181 = 19.3%). This perhaps is due to the reason that the 25th of March has a deep religious significance, while the equinox is only an astronomical date. It is worth to notice that, in the first centuries of the Christian Era, the alignment to the direction of the astronomical equinoctial sunrise-sunset line (i.e. E-W) was more common. On the contrary, during the medieval times more and more alignments towards days with a deep religious meaning were cho-

sen for orienting sacred buildings. A few lunistice (15 of 181 = 8.2%) and solstice (11 of 181 = 6%) alignments have been found especially in Venice and its Lagoon as well as in Tuscany. A number of alignments to the summer solstice are present in sacred buildings. In these cases, the light of the setting Sun enters from the rose window of the façade, crosses the whole church and exits from the one or two light windows of the apsis. This phenomenon precisely identifies the day of the summer solstice, a moment called the "highest light", representing the magnificence of Christ.

Examination of this sacred medieval architectural evidence confirms the ties that existed between the church and the heavens. Even though there are no Early Middle Ages documents that clearly tell about this tradition of the alignments of churches towards the sunrise or sunset on Mary's feast or on the Patrons Saint's day, the buildings themselves provide evidence of their orientation. This fact has been shown by the accurate examination of numerous medieval churches undertaken here, in different settings (mountains, valleys, plains and cities) and geographic areas (Switzerland, Italy: Veneto, Aosta Valley, Piedmont, Lombardy, Emilia Romagna, Tuscany) and buildings of different types (oratories, churches, parish churches, monastic churches, domos and cathedrals). Our archaeoastronomical analysis by linking georeferenced surveys and with historical written sources minimizes the likelihood that a given sacred building was aligned causally. By combining these two methodologies a forgotten tradition of the Church has been rediscovered.

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